

What is claimed is:

1. An automated medication preparation system including automated syringe preparation including reconstitution of the medication, the system comprising:

- a first automated gripping means for removing a tip cap from a barrel of one syringe and placing the removed tip cap at a first location;
- an automated device for delivering a prescribed dosage amount of medication to the syringe by delivering the medication through the uncapped barrel in a just-in-time for use manner;
- a controller in communication with the automated device and including a database for storing reconstitution information that is executable with the automated device for reconstituting the medication prior to it being injected into the syringe, wherein the reconstitution information include at least a concentration of the resultant medication and a mixing time for agitating the medication; and
- a second automated gripping means for replacing the removed tip cap on the syringe barrel after the medication is injected therein.

2. The automated system of claim 1, wherein each of the first and second automated gripping means comprises a robotic device having first and second gripping arms that are spaced apart from one another in a first position and are moved toward one another to

a second position so as to securely capture and hold the tip cap between the first and second gripping arms.

3. The automated system of claim 2, wherein the robotic device is movable at least along an x axis and a y axis.

4. The automated system of claim 1, further including:
an automated device for extending a plunger of the syringe barrel.

5. The automated system of claim 4, wherein the automated device is operatively connected to a control unit which instructs the automated device to extend the plunger a predetermined distance based on the prescribed amount of medication.

6. The automated system of claim 1, further including an automated rotary device that is indexed to advance the syringe from one station to another station, the rotary device having a first feature formed as part thereof for releasably retaining the syringe and a second feature for holding the removed tip cap as the syringe is advanced from one station to the next.

7. The automated system of claim 1, wherein the automated device for delivering a prescribed dosage amount of medication to the syringe comprises an automated robotic device that operates in accordance with signals received from the controller and

includes a cannula unit that is rotatably mounted to a vertical base which is itself rotatably mounted to a lower ground base, wherein the cannula unit includes a cannula extending thereaway for performing at least one of the following operations: (1) receiving and discharging diluent from a diluent supply in a prescribed amount to reconstitute the medication in a vial; and (2) aspirating and later discharging reconstituted medication from the vial into the syringe.

8. The automated system of claim 7, wherein the cannula is fluidly connected to a main conduit that is selectively connected at its opposite end to the diluent source and to a means for creating either negative pressure or positive within the main conduit for aspirating fluid into the main conduit or discharging fluid therefrom, respectively.

9. The automated system of claim 8, wherein the means comprises:

a collection member for storing diluent received from either the diluent source or diluent that is drawn into the collection member from a downstream section of the main conduit; and

a control unit and a valve mechanism that are operatively connected to the collection member to create negative pressure therein to draw fluid therein or to create positive pressure to force fluid to be discharged therefrom.

10. The automated system of claim 9, wherein the collection member comprises:

a first syringe having a barrel with an interior having a first volume; and
a second syringe having a barrel with an interior having a second volume;
wherein each of the first and second syringes having a slideable plunger
contained in the respective barrel and each syringe being in selective fluid communication with
each of the diluent source and the main conduit that leads to the cannula.

11. The automated system of claim 10, wherein the first volume is at least
50% greater than the second volume.

12. The automated system of claim 10, wherein the control unit comprises:
a first syringe driver associated with the first syringe for selectively moving the
plunger a prescribed distance;

a second syringe driver associated with the second syringe for selectively
moving the plunger a prescribed distance; and

the valve mechanism includes a first valve for providing selective fluid
communication between the control unit and the diluent source and a second valve for
providing selective fluid communication between the control unit and the downstream section
of the main conduit.

13. The automated system of claim 12, wherein the first and second syringes
are fluidly interconnected by a connector conduit that has a valve associated therewith for
permitting selective flow between the syringes.

17. The automated system of claim 16, further including:

a mixing device for agitating the vial with the medication and injected diluent so that the desired reconstituted medication is produced, the mixing device in communication with the central processor unit which instructs the mixing device to be actuated for the stored mixing time.

18. The automated system of claim 17, wherein the mixing device is a vortex mixer.

19. The automated system of claim 17, wherein the mixing device is an automated vibrating device having a platform that receives the vial and an adjustable hold down bar that is manipulated so that it travels towards the vial and engages the vial at an end opposite the platform such that once the vial is securely captured between the platform and hold down bar, vibrating device is actuated resulting in the vial being shaken to agitate the medication and ensure that all of the medication properly goes into solution.

20. The automated system of claim 1, further including:

a multi-use medication station where drug vials that are identified as multi-use medication vials are stored after the medication is reconstituted therein and the prescribed dosage amount is aspirated therefrom by the cannula unit.

21. The automated system of claim 20, further including:

an automated vial gripper device for retrieving and securely holding a selected vial containing the medication from a first location and transferring it to a plurality of stations downstream of the first location, the automated vial gripper device being capable of moving in the x, y, and z directions and inverting the held vial, wherein the vial gripper device delivers vials that are identified as multi-use to the multi-use station after the prescribed dosage amount is aspirated and when reconstituted medication remains in the vial.

22. The automated system of claim 7, wherein the cannula comprises a vented cannula that is selectively vented to atmosphere.

23. The automated system of claim 7, wherein the cannula comprises an automated cannula that includes a tip that is movable within a vial that holds the medication to permit all of the medication to be drawn from the vial.

24. An automated medication preparation system including automated syringe preparation including reconstitution of the medication and delivery of the reconstituted medication to a syringe, the system comprising:

an automated device for delivering a prescribed dosage amount of medication to the syringe by injecting the medication through an uncapped barrel in a just-in-time for use manner;

a controller in communication with the automated device and including a

database for storing reconstitution information that is used to control the automated device for reconstituting the medication prior to it being injected into the syringe, wherein the reconstitution information include at least a concentration of the resultant medication and a mixing time for agitating the medication; and

wherein the automated device for delivering a prescribed dosage amount of medication to the syringe comprises an automated robotic device having a cannula unit that is rotatably mounted to a vertical base which is itself rotatably mounted to a lower ground base, wherein the cannula unit includes a cannula extending thereaway for performing at least one of the following operations: (1) receiving and discharging diluent from a diluent supply in a prescribed amount to reconstitute the medication in a vial; and (2) aspirating and later discharging reconstituted medication from the vial into the syringe.

25. An automated medication preparation system including automated syringe preparation including delivery of a prescribed amount of medication to the syringe, the system comprising:

a source of medication;

a first conduit connected at one end to the source of medication and at the other end to an input port of a pump that has an output port that is connected to a second conduit that terminates at its other end in a connector;

an automated rotary device that is indexed to advance one syringe from one station to another station, the rotary device having a feature formed as part thereof for releasably retaining the syringe;

an automated device for extending a plunger of a syringe barrel positioned at a fluid transfer position of the rotary device, the automated device being operatively connected to a control unit which instructs the automated device to extend the plunger a predetermined distance based on the prescribed amount of medication; and

wherein the connector sealingly mates with an open end of the syringe barrel so that extension of the plunger creates a negative pressure condition within the barrel and results in the prescribed amount of medication being drawn therein from the second conduit.

26. The automated system of claim 25, wherein the source of medication comprises a bag filled with liquid medication.

27. The automated system of claim 25, wherein the pump is a peristaltic pump that selectively pumps medication from the source into the second conduit.

28. An automated medication preparation system including automated syringe preparation comprising:

an automated injectable drug vial delivery assembly that identifies and transfers one drug vial from a storage location to a fluid transfer station by means of a robotic vial gripper device;

an automated device disposed at the fluid transfer station for delivering a prescribed dosage amount of medication to an uncapped syringe by delivering the medication through the uncapped barrel in a just-in-time for use manner; and

the medication in the vial, then aspirating and later discharging the prescribed dosage amount of medication from the vial into the syringe in a just-in-time for use manner.

30. The method of claim 29, wherein the cannula unit is in selective fluid communication with a fluid pump apparatus that is in selective fluid communication with a diluent source, the fluid pump apparatus having a first controllable syringe that is in fluid communication with the diluent source and with a second controllable syringe that is also in selective fluid communication with the cannula unit through a primed main conduit, each of the syringes being operably connected to a drive that causes either a positive or negative pressure to exist in a barrel thereof, and the step of reconstituting the medication includes the steps of:

opening fluid communication between the diluent source and the first syringe and preventing fluid communication between the second syringe and the cannula unit;

operating a drive of one of the first and second syringes to create a negative pressure therein resulting in a prescribed amount of diluent being drawn into the barrel thereof;

preventing fluid communication between the diluent source and the first syringe and allowing fluid communication between the second syringe and the cannula unit;

operating the drive so as to discharge the prescribed amount of diluent from one of the first and second syringes into the primed main conduit resulting in the prescribed amount of diluent being discharged through the cannula and into the vial;

agitating contents of the vial;

operating a drive of one of the first and second syringes to create a negative pressure therein resulting in the prescribed dosage amount of medication being aspirated into

the main conduit with an air block separating the aspirated medication from the diluent in the main conduit due to a volume of diluent, which is equal to the prescribed dosage amount, be drawn into the syringe barrel;

positioning the cannula within the syringe; and

operating the drive of one of the first and second syringes to create a positive pressure therein resulting in the prescribed dosage amount of medication being discharged from the main conduit into the syringe as a result of the volume of diluent being discharged from the syringe into the main conduit.